

What is claimed are:

1. A variable valve control apparatus for an internal combustion engine provided with a variable valve event and lift mechanism that successively varies an operating angle and a valve lift of an intake valve of the internal combustion engine, comprising:

    a first calculating section that calculates requested opening timing and requested closing timing of said intake valve provided that controlled variable of said variable valve event and lift mechanism is a predetermined value;

    a second calculating section that calculates a requested operating angle based on said requested opening timing and said requested closing timing;

    a third calculating section that calculates a deviation between an operating angle corresponding to said controlled variable, and said requested operating angle;

    an updating section that updates said controlled variable according to said deviation until an absolute value of said deviation reaches a predetermined value or less, and executes the calculations in said first to third calculating sections repetitively based on the post-updated controlled variable;

    a setting section that sets said controlled variable of the time when the absolute value of said deviation is the predetermined value or less, to a desired value; and

    a control section that controls said variable valve event and lift mechanism based on said desired value.

2. A variable valve control apparatus for an internal combustion engine according to claim 1,

    wherein said first calculating section calculates closing timing of said intake valve at which a target intake air amount can be obtained when said controlled variable is the predetermined value, as said requested closing timing.

3. A variable valve control apparatus for an internal combustion engine according to claim 1,

    wherein said first calculating section calculates opening timing of said intake valve at which a target residual gas rate can be obtained when said controlled variable is the predetermined value, as said requested opening timing.

4. A variable valve control apparatus for an internal combustion engine according to claim 1,

    wherein said updating section determines whether said controlled variable is to be increased or to be decreased depending on whether said deviation is a positive value or a negative value.

5. A variable valve control apparatus for an internal combustion engine according to claim 1,

wherein said updating section decreases in stepwise an amount for changing said controlled variable.

6. A variable valve control apparatus for an internal combustion engine according to claim 5,

wherein said updating section changes said controlled variable by a predetermined rate of a previous change amount of said controlled variable.

7. A variable valve control apparatus for an internal combustion engine according to claim 1,

wherein said updating section sets the controlled variable set as the desired value by said setting section, as an initial value, to update the controlled variable.

8. A variable valve control apparatus for an internal combustion engine according to claim 1, further comprising:

a variable valve timing mechanism that successively varies a center phase of the operating angle of said intake valve; and

a valve timing control section that controls said variable valve timing mechanism so that said intake valve is opened and closed at said requested opening timing and said requested closing timing.

9. A variable valve control apparatus for an internal combustion engine according to claim 1,

wherein there is provided a detecting section that detects the controlled variable in said variable valve event and lift mechanism;

said control section comprises a comparison section that compares the controlled variable detected in said detecting section and said desired value, and an operating section that calculates an operating amount based on an output signal from said comparison section to apply said operating amount on said variable valve event and lift mechanism; and

a predetermined value to be compared with the absolute value of said deviation is set to a value the same as the resolution in said detecting section.

10. A variable valve control apparatus for an internal combustion engine provided with a variable valve event and lift mechanism that successively varies an operating angle and a valve lift of an intake valve of the internal combustion engine, comprising:

first calculating means for calculating requested opening timing and requested closing timing of said intake valve provided that controlled variable of said variable valve

event and lift mechanism is a predetermined value;

second calculating means for calculating a requested operating angle based on said requested opening timing and said requested closing timing;

third calculating means for calculating a deviation between an operating angle corresponding to said controlled variable, and said requested operating angle;

updating means for updating said controlled variable according to said deviation until an absolute value of said deviation reaches a predetermined value or less, and executes the calculations in said first to third calculating means repetitively based on the post-updated controlled variable;

setting means for setting said controlled variable of the time when the absolute value of said deviation is the predetermined value or less, to a desired value; and

control means for controlling said variable valve event and lift mechanism based on said desired value.

11. A variable valve control method for an internal combustion engine provided with a variable valve event and lift mechanism that successively varies an operating angle and a valve lift of an intake valve of the internal combustion engine, comprising the steps of:

calculating requested opening timing and requested closing timing of said intake valve provided that controlled variable of said variable valve event and lift mechanism is a predetermined value;

calculating a requested operating angle based on said requested opening timing and said requested closing timing;

calculating a deviation between an operating angle corresponding to said controlled variable, and said requested operating angle;

updating said controlled variable according to said deviation until an absolute value of said deviation reaches a predetermined value or less;

repeating the calculations of said requested opening timing, said requested closing timing and said deviation based on the post-updated controlled variable;

setting said controlled variable of the time when the absolute value of said deviation is the predetermined value or less, to a desired value; and

controlling said variable valve event and lift mechanism based on said desired value.

12. A variable valve control method for an internal combustion engine according to claim 11,

wherein said step of calculating said requested closing timing comprises the steps of:

calculating a target intake air amount; and

calculating closing timing of said intake valve at which said target intake air amount can be obtained when said controlled variable is the predetermined value, as said requested

closing timing.

13. A variable valve control method for an internal combustion engine according to claim 11,

wherein said step of calculating said requested closing timing comprises the steps of:

calculating a target residual gas rate; and

calculating opening timing of said intake valve at which said target residual gas rate can be obtained when said controlled variable is the predetermined value, as said requested opening timing.

14. A variable valve control method for an internal combustion engine according to claim 11,

wherein said step of updating said controlled variable comprises the steps of:

judging whether said controlled variable is a positive value or a negative value; and

determining whether said controlled variable is to be increased or to be decreased depending on whether said deviation is the positive value or the negative value.

15. A variable valve control method for an internal combustion engine according to claim 11,

wherein said step of updating said controlled variable comprises the step of; decreasing in stepwise an amount for changing said controlled variable.

16. A variable valve control method for an internal combustion engine according to claim 11,

wherein said step of updating said controlled variable comprises the steps of:

calculating a previous change amount of said controlled variable;

calculating a predetermined rate of said previous change amount, as a present change amount; and

changing said controlled variable based on said present change amount.

17. A variable valve control method for an internal combustion engine according to claim 11,

wherein said step of updating said controlled variable comprises the step of; setting the controlled variable set as the desired value, as an initial value.

18. A variable valve control method for an internal combustion engine according to claim 11,

wherein said internal combustion engine comprises a variable valve timing

mechanism that successively varies a center phase of the operating angle of said intake valve; and

    said method further comprises the step of;

    controlling said variable valve timing mechanism so that said intake valve is opened and closed at said requested opening timing and said requested closing timing.

19. A variable valve control method for an internal combustion engine according to claim 11,

    wherein said method further comprises the step of detecting the controlled variable in said variable valve event and lift mechanism,

    said step of controlling said variable valve event and lift mechanism comprises the steps of:

        comparing a detection value of said controlled variable and said desired value;

        calculating an operating amount based on said comparison result; and

        applying said operating amount on said variable valve event and lift mechanism, and

        a predetermined value to be compared with the absolute value of said deviation is set to a value the same as the detection resolution of said controlled variable.